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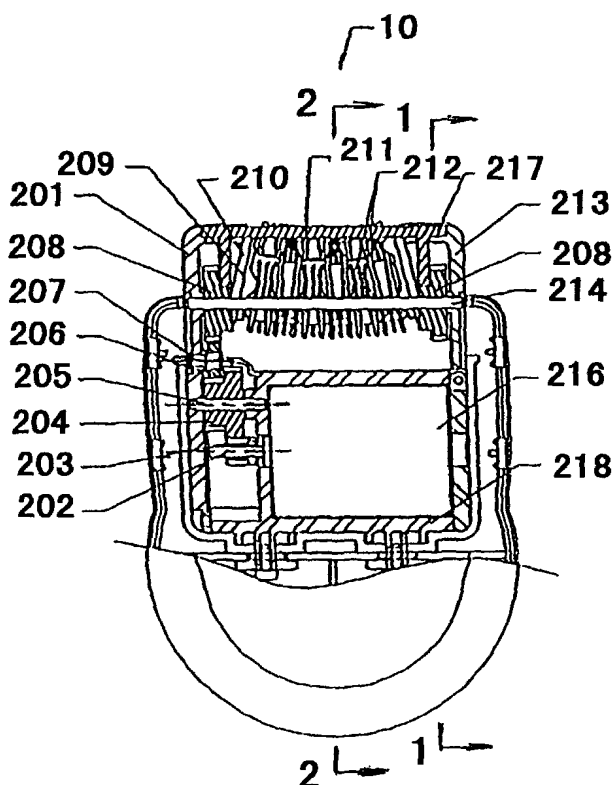
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[Continued on next page]

(54) Title: HAIR REMOVAL DEVICE WITH DISC, VIBRATION, AND LIGHT ASSEMBLIES



(57) Abstract: A device for removing unwanted hair, including a hair-plucking assembly, a vibration assembly, a driving assembly, and a housing. The hair-plucking assembly includes at least two groups of disc assemblies that remove hairs as they rotate. In an alternative embodiment, disc assemblies are arranged in at least two rows, where disc assemblies arranged in one row rotate in an opposite direction to disc assemblies arranged in another row. As the hair-plucking assembly removes hair, the vibration assembly vibrates to massage the area of hair removal to minimize discomfort associated with the hair removal. In addition, an illumination mechanism may be added to the hair removal device to illuminate the hair removal area so as to help the user see the progress of hair removal.

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## HAIR REMOVAL DEVICE WITH DISC, VIBRATION, AND LIGHT ASSEMBLIES

This is a continuation-in-part of application serial no. 09/669,378, filed  
5 September 26, 2000, which is itself a continuation-in-part of application serial no.  
09/246,454, filed February 9, 1999 and issued on September 26, 2000 as U.S. Patent No.  
6,123,713, which is itself a continuation-in-part of application serial no. 09/112,971, filed  
July 9, 1998 and issued November 2, 1999 as U.S. Patent No. 5,976,157.

### 10 FIELD OF THE INVENTION

The present invention relates generally to a depilatory device for removal of  
unwanted hair, and more specifically, to a device for removing unwanted hair by trapping  
and uprooting the hair while at the same time massaging the hair-removal area to reduce  
15 discomfort associated with hair removal.

### BACKGROUND OF THE INVENTION

There exists a need for removal of unwanted hair in order to maintain a  
20 desirable physical appearance. There are many devices known in the art that are useful for  
removing unwanted hair such as razors, tweezers and other depilatory devices. Although  
razors provide quick and easy hair removal, hair remains visible at the surface of the skin  
and quickly regrows. Therefore one must shave frequently in order to maintain smooth skin  
and a desired appearance.

25 On the other hand, tweezers provide longer-lasting hair removal than razors  
since, instead of merely cutting hair, tweezers remove the hair at its root. However,  
removing hair with tweezers is a tedious process since traditional tweezers can only remove  
one hair at a time and precise handling of the tweezers is required in order to position and  
30 grasp the hair between the two, usually small, opposing surfaces. Furthermore, care must be  
taken so that the hair is not inadvertently broken above the root leaving stubbles.

Other depilatory devices are known in the art such as one described in U.S.  
Patent No. 5,281,233 to Dolev ("Dolev patent"). The Dolev hair removal device generally  
35 comprises a housing and a hair-plucking assembly rotatably mounted to the housing. The

hair plucking assembly includes at least one disc assembly comprising (i) a pair of complementary discs, each of the discs having at least three radially extending arms terminating in flattened peripheral portions, which, when pressed against corresponding flattened peripheral portion of the arms of the other disc, form a trap for the hair; and (ii) a  
5 hub for accommodating and rotating the pair of discs so that the flattened peripheral portions of the discs are alternately brought together to form a trap to grasp the hair to be removed, and forced apart to eject the removed hair. The Dolev hair device, however, merely includes one row of disc assemblies, which limits the number of hairs it can remove at one time. Moreover, it lacks any mechanism for making the hair-removal process more  
10 comfortable for the user.

There is a need, therefore, for a depilatory device that is as easy and inexpensive to assemble and maintain as prior art devices but, at the same time, can easily uproot a greater number of hairs over a larger hair-removal area than is currently possible.  
15 In addition, there is also an ongoing need for depilatory devices that reduce discomfort associated with hair removal.

## SUMMARY OF THE INVENTION

20 According to the present invention, the foregoing and other objects and advantages are attained by a hair removal device comprising a housing and a hair-plucking assembly. In preferred embodiments, the hair-removal assembly includes at least two groups of disc assemblies mounted within the housing. The disc assemblies may be arranged in at least two rows, which may be adjacent and/or parallel to one another. Disc  
25 assemblies arranged in a row may be rotationally fixed with respect to one another and may rotate together at a constant speed. In addition, disc assemblies arranged in one row may rotate in an opposite direction with respect to disc assemblies arranged in another row.

The disc assemblies may also be identical to one another. Each disc  
30 assembly may include an internal disc assembly and a pair of outer discs. Each internal disc may, in turn, comprise an insert disc having at least one arm and may be mounted on a disc carrier. Each outer disc may also have at least one arm and may be mounted on the internal disc assembly. The arm(s) of each outer disc may be pressed against the arm(s) of the internal disc to form traps for hair.

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The disc carrier may further comprise at least one U-shaped member for engaging at least one arm of each of the pair of outer discs so as to impart rotational motion to the pair of outer discs upon rotation of the internal structure about an axis of the internal structure. The disc carrier may further comprise at least a pair of pinchers that extends  
5 axially from the U-shaped member(s) beyond the plane of the arm of each of the pair of outer discs for imparting a clamping force on at least one adjacent disc carrier. The disc carrier may further comprise engagement means for engaging at least one adjacent disc carrier so that rotational movement of one disc carrier imparts rotational motion to at least one adjacent disc carrier. The engagement means may comprise engagement protrusions  
10 and engagement recessions for engaging corresponding protrusions and recessions of at least one adjacent disc carrier. Finally, disc assemblies may be rotatably mounted on two shafts. The shafts may further be curved so that the disc assemblies are mounted in an inclined angle.

15 The hair removal device may further comprise an illumination mechanism that comprises a light source. Preferably, the light source may be an incandescent light bulb or an light-emitting diode located near the hair removal area for better lighting. In addition, the light source may be oriented at an angle to better illuminate the hair removal area. The illumination mechanism may further comprise a battery housing that houses a battery for  
20 supplying power to the light source. In the alternative, the illumination mechanism may draw power from the hair removal device for powering the light source. The illumination mechanism may be detachable from the hair removal device.

In accordance with another preferred embodiment of the invention, the hair  
25 removal device may comprise a housing, a hair-plucking assembly, and a vibration assembly mounted within the housing. The vibration assembly may comprise a vibration element to massage the hair removal area. This vibration element may be rotatably mounted on eccentric cylinders and may vibrate at a constant speed.

30 The housing may comprise brackets for mounting the hair-plucking assembly and vibration assembly to the housing. The vibration element may be located adjacent to the hair-plucking assembly and may act to move towards and away from the hair-plucking assembly. The vibration element may span at least the width of the hair-plucking assembly.

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As discussed above, the hair-plucking assembly may comprise disc assemblies which are arranged in two rows, wherein the vibration element may be located between the rows of disc assemblies. The hair-plucking assembly and the vibration assembly may be powered by a driving assembly.

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### BRIEF DESCRIPTION OF THE DRAWINGS

For a more complete understanding of the present invention, reference is made to the following Detailed Description taken in conjunction with the accompanying  
10 drawings in which:

FIG. 1 is a front elevational view of a hair remover according to the invention;

FIG. 2 is a top plan view of the hair remover of Fig. 1;

FIG. 3 is a side elevational view of the hair remover of Fig. 1;

15 FIG. 4 is a front partial section view of the hair remover of Fig. 1 taken along line A-A of FIG. 3, featuring a number of disc assemblies;

FIG. 5 is a side partial section view taken along line 2-2 of the hair remover of Fig. 4;

FIG. 6 is a front partial section view of the hair remover of Fig. 1 taken along line B-B of FIG. 5, featuring a number of disc assemblies;

20 FIG. 7 is an exploded view of the outer discs and the internal disc assembly of the invention;

FIG. 8 is a plan view of the disc assembly of FIG. 6, such as might be used in the device of FIG. 1;

FIG. 9 is a perspective view of the disc assembly of FIG. 7;

25 FIG. 10 is a perspective view of a vibration system in the hair remover of FIG. 1;

FIG. 11 is a side cross-sectional view taken along line 1-1 of FIG. 4 illustrating the vibration assembly with vibration element in a low position;

FIG. 12 is a side cross-sectional view similar to Fig. 10 of the vibration assembly with the vibration element in a high position;

30 FIG. 13 is the same view as FIG. 11, but of an alternative embodiment with oppositely rotating disc assemblies;

FIG. 14 is the same view as FIG. 12 of the alternative embodiment;

FIG. 15 is a front view of an illumination mechanism attached to a hair removal device;

FIG. 16 is a side view of the illumination mechanism attached to a hair removal device;

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FIG. 17 is a perspective view of the illumination mechanism attached to a hair removal device; and

FIG. 18 is a top view of the illumination mechanism attached to a hair removal device.

## 5 DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIGs. 1-12 illustrate a preferred embodiment of the hair removal device 10 according to the present invention. As shown in FIGs. 1-12, hair removal device 10 preferably includes a hair-plucking assembly 14 (FIG. 1, 2), a vibration assembly 603 (FIG. 9), a driving assembly 216, 202-207 (FIG. 4, 6), and a housing 17 (FIG. 3).

As shown in FIGs. 1-2, hair-plucking assembly 14 preferably includes, among other components described further below, a plurality of disc assemblies 500. A preferred embodiment of disc assembly 500 is illustrated in further detail in FIGs. 7-9. As shown in Fig. 7, each disc assembly 500 preferably includes three main elements: an internal disc assembly 301 and two outer discs 212. Each internal disc assembly 301 includes a disc carrier 302 and an insert disc 501. Each disc carrier 302, in turn, includes U-shaped members 305, opposing pinchers 306, engagement protrusions 303, and engagement recessions 304. Each insert disc 501 and outer disc 212 includes three radially extending arms oriented approximately 120° apart with each arm terminating in flattened peripheral portions 502 and 402 respectively.

U-shaped members 305 of disc carrier 302 imparts rotational motion to outer discs 212. In addition, U-shaped members 305 serve as platforms for opposing pinchers 306, elevating opposing pinchers 306 out of the plane of radially extending arms 401 of outer disc 212 when outer disc 212 is mounted on internal disc assembly 301, as may be appreciated in FIG. 9. Opposing pinchers 306 exert pressure on flattened peripheral portions 402 of adjacent disc assemblies 500 in order to form traps for hair, as described in further detail below. Engagement protrusions 303 and engagement recessions 304 connect adjacent disc assemblies 500 together, as described in further detail below.

As illustrated in FIG. 7, the central portion of each outer disc 212 preferably includes a generally circular opening, which is sized and shaped so that each outer disc 212 may be mounted on internal disc assembly 301, as illustrated in FIG. 9. The configuration, *i.e.*, dimensions and tolerances, of components 212, 303 of each disc assembly 500 is

designed such that these components fit snugly together and remain engaged during operation of the device 10 (FIG. 1).

When outer discs 212 are mounted on internal disc assembly 301, flattened peripheral portions 402 of outer discs 212 are aligned with flattened peripheral portion 502 of internal disc assembly 301, so that when flattened peripheral portions 402 are pressed against the corresponding flattened peripheral portion 502, as illustrated in FIG. 9, traps that can grasp and hold hair are formed between flattened peripheral portion 502 and adjacent flattened peripheral portions 402.

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It should be noted that, in alternative embodiments, disc assembly 500 may include one or two integral pieces having between them all the elements of the three components 212, 301, 212 discussed above. In addition, it should be noted that any hair-plucking disc assembly may be used, including the disc assembly described in Dolev's patent 5,281,233. We, therefore, incorporate by reference the disc assembly described in Dolev.

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As shown in FIGs. 4-6, in addition to a plurality of disc assemblies 500, hair-plucking assembly 14 also preferably includes shafts 219, bearings 210, bearing supports 209, and disc drive gears 220.

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Shafts 219 are preferably curved for mounting disc assemblies 500. Mounting disc assemblies 500 on curved shafts 219 allows disc assemblies 500 to form traps for hair, as described in further detail below. Shafts 219 may be made of any appropriate material, including various rigid or flexible materials; however, appropriate support must be provided for curved shafts made of flexible material. Bearings 210 and bearing supports 209 transfer rotational force from disc drive gears 220 to disc assemblies 500 as well as ensure smooth rotation of disc assemblies 500. Disc drive gears 220 impart rotational motion to disc assemblies 500 through bearings 210 and bearing supports 209.

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In the preferred embodiment illustrated in FIGs. 4-6, each disc assembly 500 is rotatably mounted on shafts 219, wherein each disc assembly 500 is engaged to adjacent disc assembly or assemblies 500 via engagement protrusions 303 and recessions 304. Specifically, each engagement protrusion 303 of one disc assembly 500 is inserted into an engagement recession 304 of an adjacent disc assembly 500 in a gear-like fashion. As a

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consequence of engaging disc assemblies 500, each disc assemblies 500 is angularly offset from adjacent disc assemblies 500 by  $60^{\circ}$  so that flattened peripheral portions 402 of a disc assembly 500 are aligned with opposing pinchers 306 of adjacent disc assemblies 500. Moreover, disc assemblies 500 engaged to one another are rotationally fixed with respect to one another so that they rotate in sync.

Bearings 210 and bearing supports 209 are placed between each end of each row of disc assemblies 500 and disc driving gears 220, respectively, to transfer rotation speed from disc driving gears 220 to hair-plucking assembly 14 as well as to facilitate smooth and steady rotation of disc assemblies 500. Disc driving gears 220 provide rotational motion to hair-plucking assembly 14.

Preferably, the portions of disc assembly 500 intended for contact with the hair are made of a metal material such as stainless steel, which is particularly effective for plucking hair, and the portions of disc assembly 500 which contact curved shafts 219 are made of plastic such as Acetal plastic to facilitate smooth rotation of the disc assembly 500. Alternatively, these components may be made up of other appropriate materials known in the art.

It should be noted that, although FIGs. 2 and 4 show that the preferred embodiment includes six disc assemblies 500 in each row of disc assemblies, in alternative embodiments, any number of disc assemblies 500 may be included in each row. In addition, it should be noted that shafts 219 need not be curved if the particular disc assemblies used do not require mounting in an inclined angle to best trap hair.

Turning now to a preferred embodiment of vibration assembly 603 depicted in FIGs. 10-12, vibration assembly 603 includes a vibration element 217, vibration assembly gear 208, and eccentric cylinder 601. Vibration element 217 is rotatably mounted on eccentric cylinder 601, which are, in turn, fixed to vibration assembly gear 208. Vibration element 217 may be made of any hard and rigid material capable of withstanding all kinds of forces and scratches by vibration gear 208. Moreover, the surface of vibration element 217, which makes contact with the skin of the user, may be smooth or textured to provide various desired massage sensations. Mounting vibration element 217 on eccentric cylinder 601 allows vibration assembly gear 208 to impart motion to vibration element 217

as vibration assembly gears 208 rotate. This creates vibrations resulting in the massaging function of the present invention, as described in further detail below.

Turning now to a preferred embodiment of a driving assembly depicted in  
5 FIGs. 4 and 6, the driving assembly includes a motor 216, a motor shaft 202, a motor shaft gear 203, a reduction gear 204, a reduction gear shaft 205, a transmission gear 206, and a transmission gear shaft 207. Motor 216 drives both hair-plucking assembly 14 (FIG. 1) as well as vibration assembly 603 (FIG. 9) via reduction gear system 202-207, and can be any type of motor capable of imparting rotational motion to the reduction gear system 202-207.  
10 Motor 216 may be operated by any convenient and available power source such as a battery or house current via a DC adaptor. Motor shaft gear 203, reduction gear 204, and transmission gear 206 are mounted on motor shaft 202, reduction gear shaft 205, and transmission gear shaft 207 respectively. Motor shaft gear 203 is engaged with reduction gear 204, which is, in turn, engaged with transmission gear 206 to form a reduction gear  
15 system that converts the rotational speed imparted by motor 216 to a proper rotational speed to drive hair-plucking assembly 14 and vibration assembly 603.

Turning now to a preferred embodiment of housing 17 depicted in FIGs. 1-6, housing 17 preferably includes two cooperating housing halves 11, 13 (FIG. 3), brackets  
20 201, 213 (FIGs. 2, 4, 6), motor housing 218 (FIG. 4, 6), and power switch 15 (FIGs. 1, 3). Housing halves 11, 13 are ergonomically shaped to facilitate easy and comfortable gripping by one hand and is preferably constructed of plastic, although alternative materials may also be used. Brackets 201, 213 hold hair-plucking assembly 14 (FIG. 1) and vibration  
assembly 603 (FIG. 10) in place within housing 17. Similarly, motor housing 218 holds  
25 motor 216 and reduction gear system 202-207 in place within housing 17 for proper operation.

In operation, when a preferred embodiment of hair-removal device 10 as illustrated in FIG. 4 is turned on via on/off switch 15 (FIGs. 1, 3), motor 216 is activated  
30 and imparts rotational force to motor shaft 202, which, in turn, imparts rotational force to motor shaft gear 203. Motor shaft gear 203, in turn, drives reduction gear 204 which drives transmission gear 206. Transmission gear 206 then imparts rotational force to vibration gear 208. Vibration gear 208, in turn, drives disc drive gears 220.

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As disc drive gears 220 rotate, they drive bearings 210 and bearing supports 209. Bearings 210 and bearing supports 209, in turn, drive disc assemblies 500 (FIGs. 7-9). As was described above, the two rows of disc assemblies 500 are mounted on curved shafts 219 (FIGs. 3, 5, 6). This curvature results in disc assemblies 500 having little room  
5 between one another near the top of the hair removal device 10 so that disc assemblies 500 are actually compressed together at the top of the hair removal device 10. This compression of disc assemblies at the top of the hair removal device 10 creates traps for hair. Specifically, when disc assemblies 500 rotate, they are compressed, or push against one another, at the top of the hair removal device 10. As a result, opposing pinchers 306  
10 mounted on U-shaped members 305 presses flattened peripheral portions 402 of adjacent disc assemblies 500 against their corresponding flattened peripheral portions 502, as illustrated in FIG. 7-9 Pressing flattened peripheral portions 402 against corresponding peripheral portions 502 forms traps for hair, as was described above and illustrated in FIG. 9.

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While hair-plucking assembly 14 is driven by disc drive gears 220, vibration gear 208 drives vibration assembly 603, wherein eccentric cylinder 601 lifts and lowers the vibration element 217 rapidly, as vibration gear 208 rotates, in order to generate the massage function of the present invention. Specifically, when vibration gear 208 rotates to  
20 the position shown in FIG. 11, vibration beam 217 moves to a low position close to disc assemblies 500. When vibration gear 208 rotates to the position shown in FIG. 12, vibration beam 217 moves to a high position away from disc assemblies 500. Therefore, as vibration gear 208 rotates continuously, vibration beam 217 moves towards and away from disc assemblies 500 rapidly, creating vibrations that massage the hair removal area.

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Disc assemblies 500 in hair removal device 10 as described above rotate in the same direction (either all clockwise or all counterclockwise). In an alternative embodiment, the device may be modified so that disc assemblies 500 can rotate in opposite directions. Such an alternative embodiment uses a modified gear system illustrated in  
30 FIGs. 13 and 14. As shown in FIGs. 13 and 14, the modified gear system of hair removal device 20 includes an extra gear 221 and a smaller vibration gear 308 and eccentric cylinder 701 to accommodate the additional gear 221.

35 In operation, transmission gear 206 drives gear 221, which, in turn, drives one of the disc drive gears 220 as well as vibration gear 308. Vibration gear 308 then drives

the other disc drive gear 220 and vibration beam 217. By using separate gears (gear 221 and vibration gear 308) to drive each disc drive gears 220 separately, disc drive gears 220 are able to rotate in opposite directions, resulting in disc assemblies 500 mounted in one row rotating in an opposite direction to disc assemblies 500 mounted in another row.

- 5 Preferably, each row of disc assemblies 500 rotates away from each other so that the removed hairs are directed away from hair removal device 20 and skin in the area of hair removal is stretched to reduce discomfort associated with hair removal.

For both hair remover embodiments 10 and 20 described above as well as the  
10 hair remover device described in related patent U.S. Patent No. 5,976,157, an illumination mechanism for illuminating the area of hair removal may be added, making it easier for a user to see the progress of hair removal. A preferred embodiment of illumination mechanism 800 is depicted in FIGs. 15-18.

15 Illumination mechanism 800 is preferably located near disc assemblies 500, (see, e.g. FIG. 1 and 2), so that it is close to the hair removal area. Preferably, light source 802 for illumination mechanism 800 is an incandescent light bulb or a light-emitting diode and is preferably oriented at an angle so as to maximize light directed to the hair removal area. In addition, illumination mechanism 800 may include a battery for powering light  
20 source 802. The battery may be contained in battery housing 804 built into illumination mechanism 800. In an alternative embodiment, illumination mechanism 800 may draw power from the hair remover itself so that a separate battery solely for powering illumination mechanism 800 is not required. Illumination mechanism 800 may also be a self-contained unit that can be attached or detached from the hair remover.

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It should be noted that the disclosed embodiments can be modified by a person skilled in the art without deviating from the scope of the present invention. For example, the orientation of hair-plucking assembly 14 in relation to housing 17 may be varied in any number of alternative configurations to optimize efficiency and convenience  
30 of use. Examples of suitable alternative configurations are described in the above-mentioned Dolev patent, incorporated herein by reference in its entirety. In addition, there can be any number of rows of disc assemblies 500 in hair remover 10 or hair remover 20.

While the invention has been described in conjunction with specific  
35 embodiments, it is evident that numerous alternatives, modifications, and variations will be

apparent to those skilled in the art in light of the forgoing descriptions. The scope of this invention is defined only by the following claims.

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What Is Claimed Is:

1. A hair removal device comprising:
  - (a) a housing;
  - (b) a hair-plucking assembly having at least two groups of disc assemblies arranged in at least two rows and mounted within said housing, wherein said disc assemblies arranged in one row rotate in an opposite direction to disc assemblies arranged in another row.
2. The hair removal device of claim 1, further comprising an illumination mechanism that illuminates area of hair removal.
3. The hair removal device of claim 2, wherein said illumination mechanism comprises a light source.
4. The hair removal device of claim 3, wherein said light source is an incandescent light bulb.
5. The hair removal device of claim 3, wherein said light source is a light-emitting diode.
6. The hair removal device of claim 3, wherein said light source is located close to the hair-plucking assembly so as to better illuminate the area of hair removal.
7. The hair removal device of claim 3, wherein said light source is oriented at an angle to better direct light to the area of hair removal.
8. The hair removal device of claim 2, wherein said illumination mechanism further comprises a battery housing that houses a battery for supplying power to said illumination mechanism.
9. The hair removal device of claim 2, wherein said illumination mechanism draws power from said hair removal device that powers said illumination mechanism.

10. The hair removal device of claim 2, wherein said illumination mechanism is detachable from said hair removal device.
11. A hair removal device comprising:
- 5 (a) a housing;
- (b) a hair-plucking assembly having at least two groups of disc assemblies mounted within said housing arranged in at least two rows, wherein said disc assemblies arranged in one row rotate in an opposite direction to disc assemblies arranged in another row; and
- 10 (c) a vibration assembly mounted within said housing.
12. The hair removal device of claim 11, further comprising an illumination mechanism.
13. The hair removal device of claim 12, wherein said illumination mechanism comprises a light source.
- 15 14. The hair removal device of claim 13, wherein said light source is an incandescent light bulb.
- 20 15. The hair removal device of claim 13, wherein said light source is a light-emitting diode.
- 25 16. The hair removal device of claim 13, wherein said light source is located close to the hair-plucking assembly so as to better illuminate the area of hair removal.
- 30 17. The hair removal device of claim 13, wherein said light source is oriented at an angle to better direct light to the area of hair removal.
- 35 18. The hair removal device of claim 12, wherein said illumination mechanism further comprises a battery housing that houses a battery for supplying power to said illumination mechanism.

19. The hair removal device of claim 12, wherein said illumination mechanism draws power from said hair removal device that powers said illumination mechanism.
- 5 20. The hair removal device of claim 12, wherein said illumination mechanism is detachable from said hair removal device.
21. A hair removal device comprising:  
10 (a) a housing;  
(b) a hair-plucking assembly mounted within said housing; and  
(c) an illumination mechanism mounted to said housing.
22. The hair removal device of claim 21, wherein said illumination mechanism comprises a light source.
- 15 23. The hair removal device of claim 22, wherein said light source is an incandescent light bulb.
24. The hair removal device of claim 22, wherein said light source is a light-emitting diode.
- 20 25. The hair removal device of claim 22, wherein said light source is located close to the hair-plucking assembly so as to better illuminate the area of hair removal.
- 25 26. The hair removal device of claim 22, wherein said light source is oriented at an angle to better direct light to the area of hair removal.
27. The hair removal device of claim 21, wherein said illumination mechanism further comprises a battery housing that houses a battery for supplying power to said illumination mechanism.
- 30 28. The hair removal device of claim 21, wherein said illumination mechanism draws power from said hair removal device that powers said illumination mechanism.
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29. The hair removal device of claim 21, wherein said illumination mechanism is detachable from said hair removal device.
30. A hair removal device comprising:  
5 (a) a housing;  
(b) a hair removal assembly mounted within said housing; and  
(c) an illumination mechanism mounted to said housing wherein said illumination mechanism is detachable from said housing.
- 10 31. The hair removal device of claim 30, wherein said illumination mechanism comprises a light source.
32. The hair removal device of claim 31, wherein said light source is an incandescent light bulb.
- 15 33. The hair removal device of claim 31, wherein said light source is a light-emitting diode.
34. The hair removal device of claim 31, wherein said light source is located close to the hair-plucking assembly so as to better illuminate the area of hair removal.
- 20 35. The hair removal device of claim 31, wherein said light source is oriented at an angle to better direct light to the area of hair removal.
- 25 36. The hair removal device of claim 30, wherein said illumination mechanism further comprises a battery housing that houses a battery for supplying power to said illumination mechanism.
- 30 37. The hair removal device of claim 30, wherein said illumination mechanism draws power from said hair removal device for powering said illumination mechanism.
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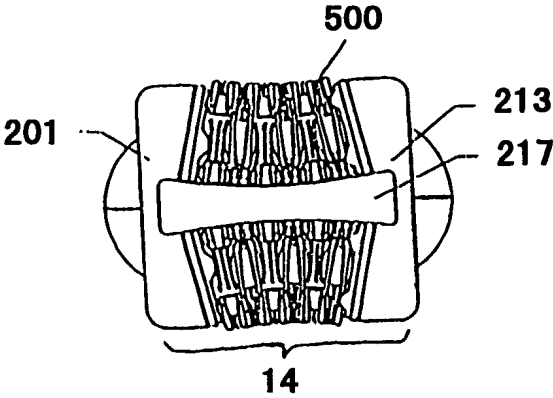


FIG. 2

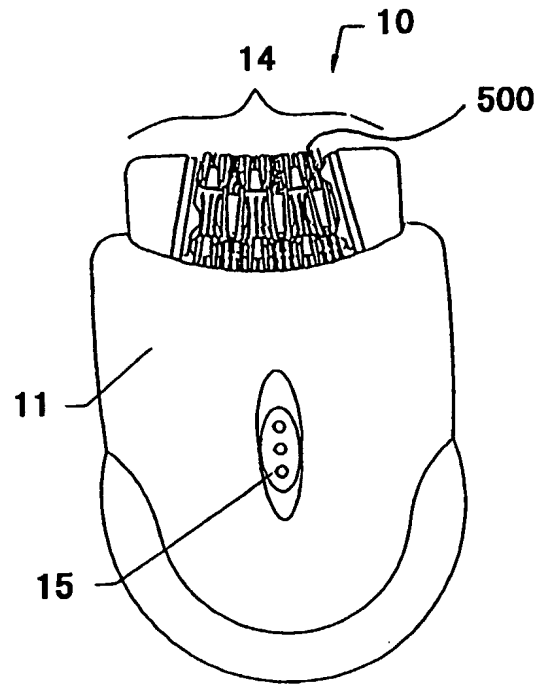


FIG. 1

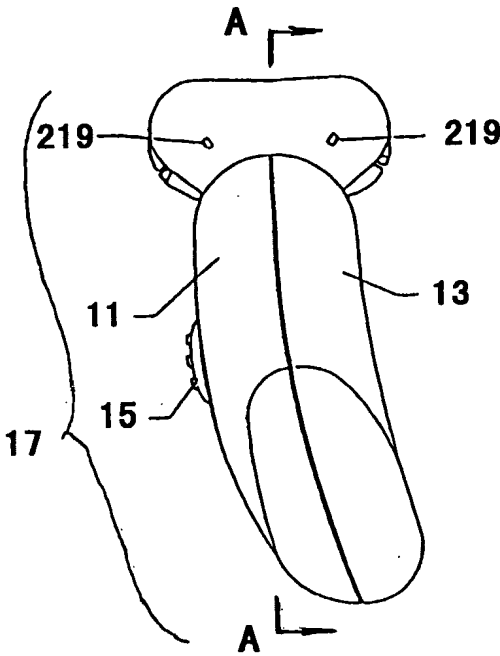


FIG. 3

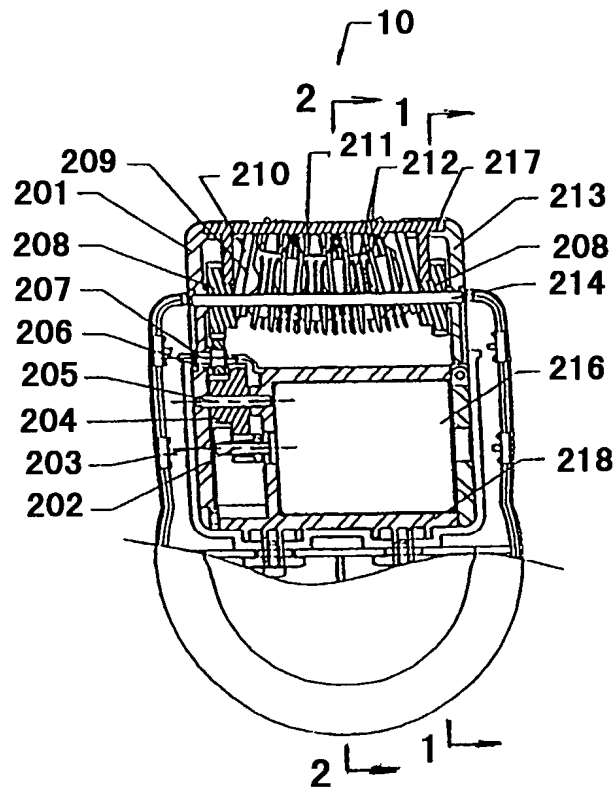


FIG. 4

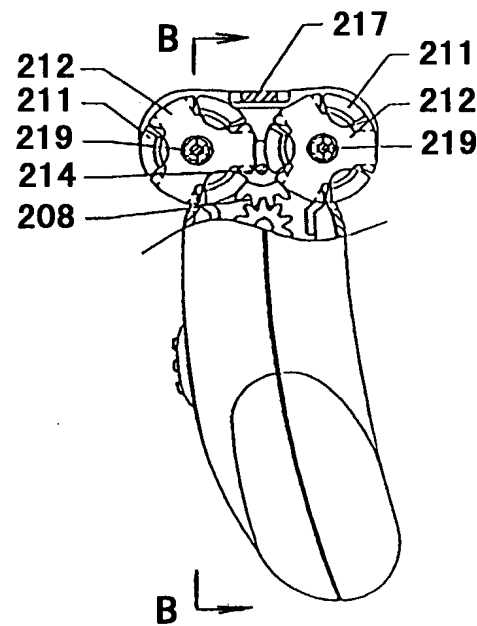


FIG. 5

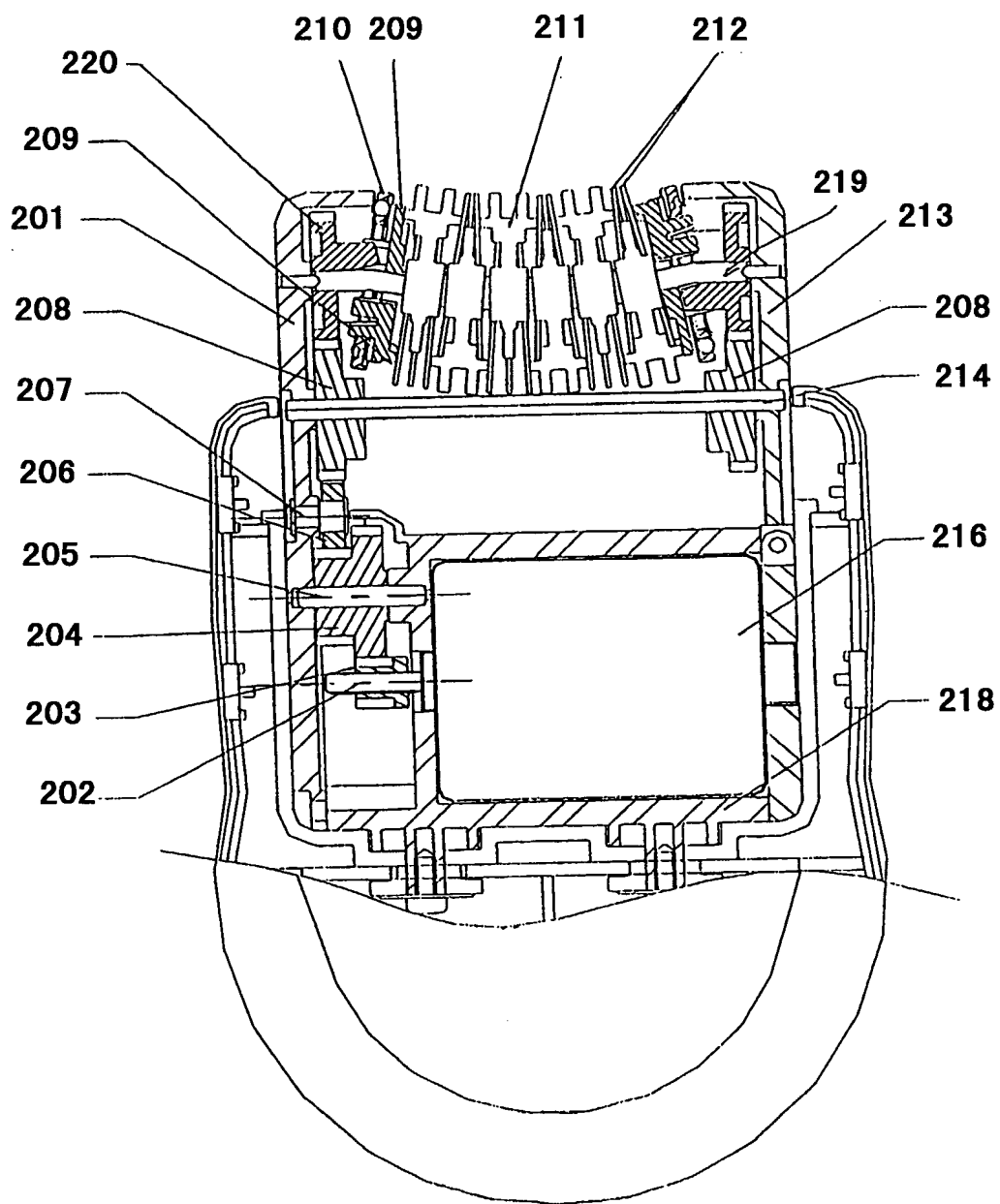


FIG. 6

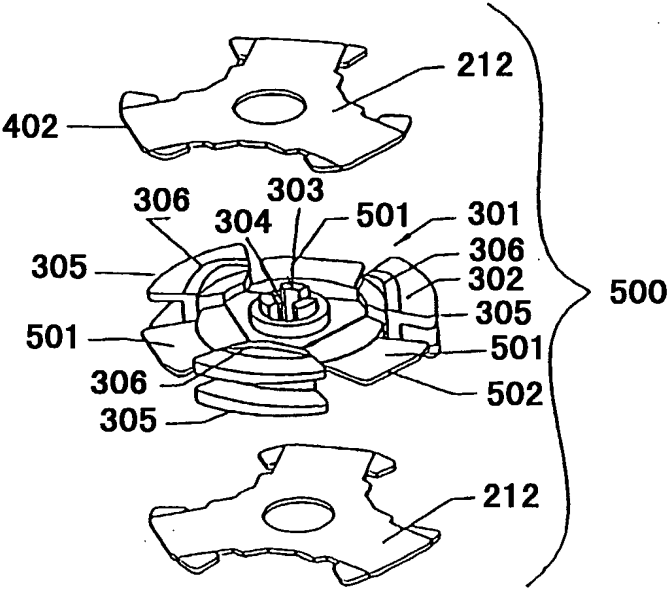


FIG. 7

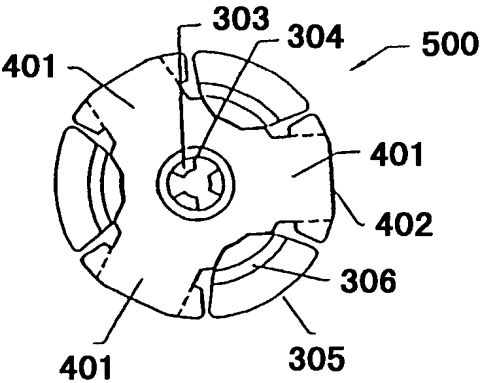


FIG. 8

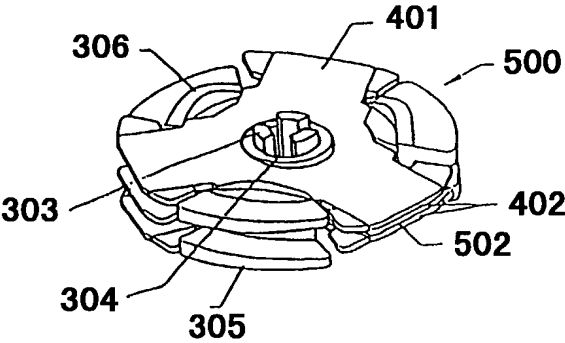


FIG. 9

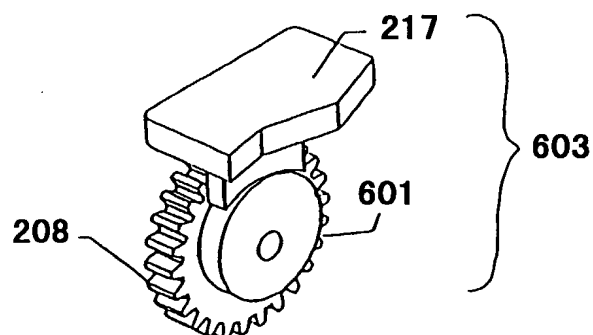


FIG. 10

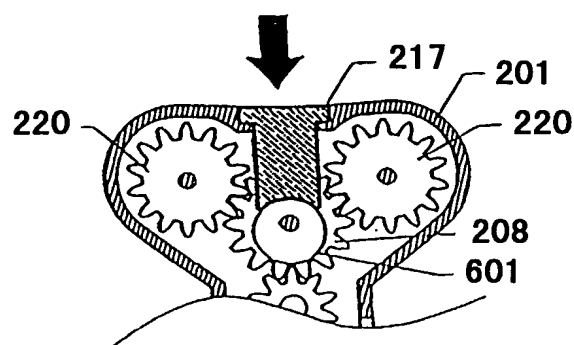


FIG. 11

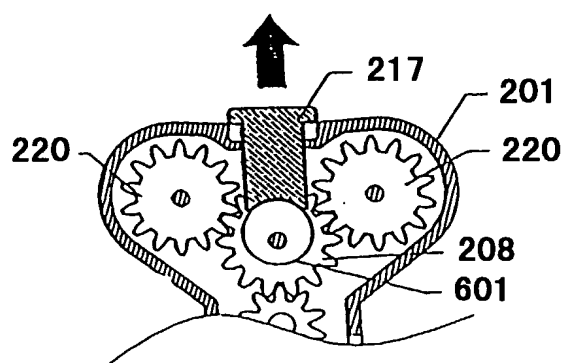


FIG. 12

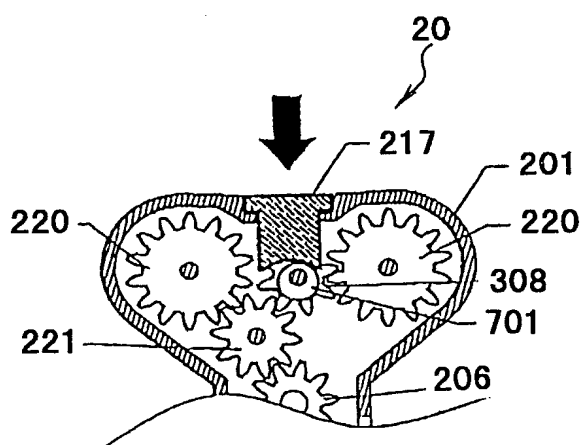


FIG. 13

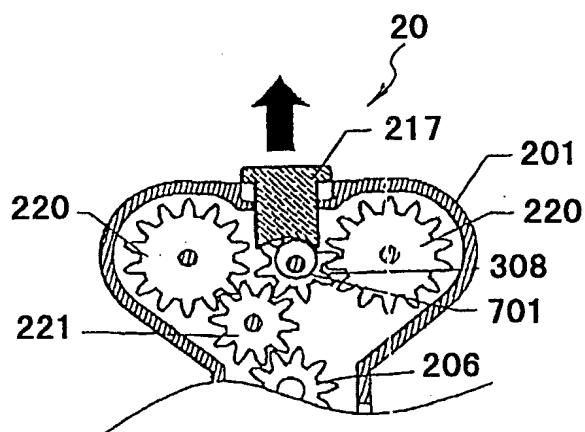


FIG. 14

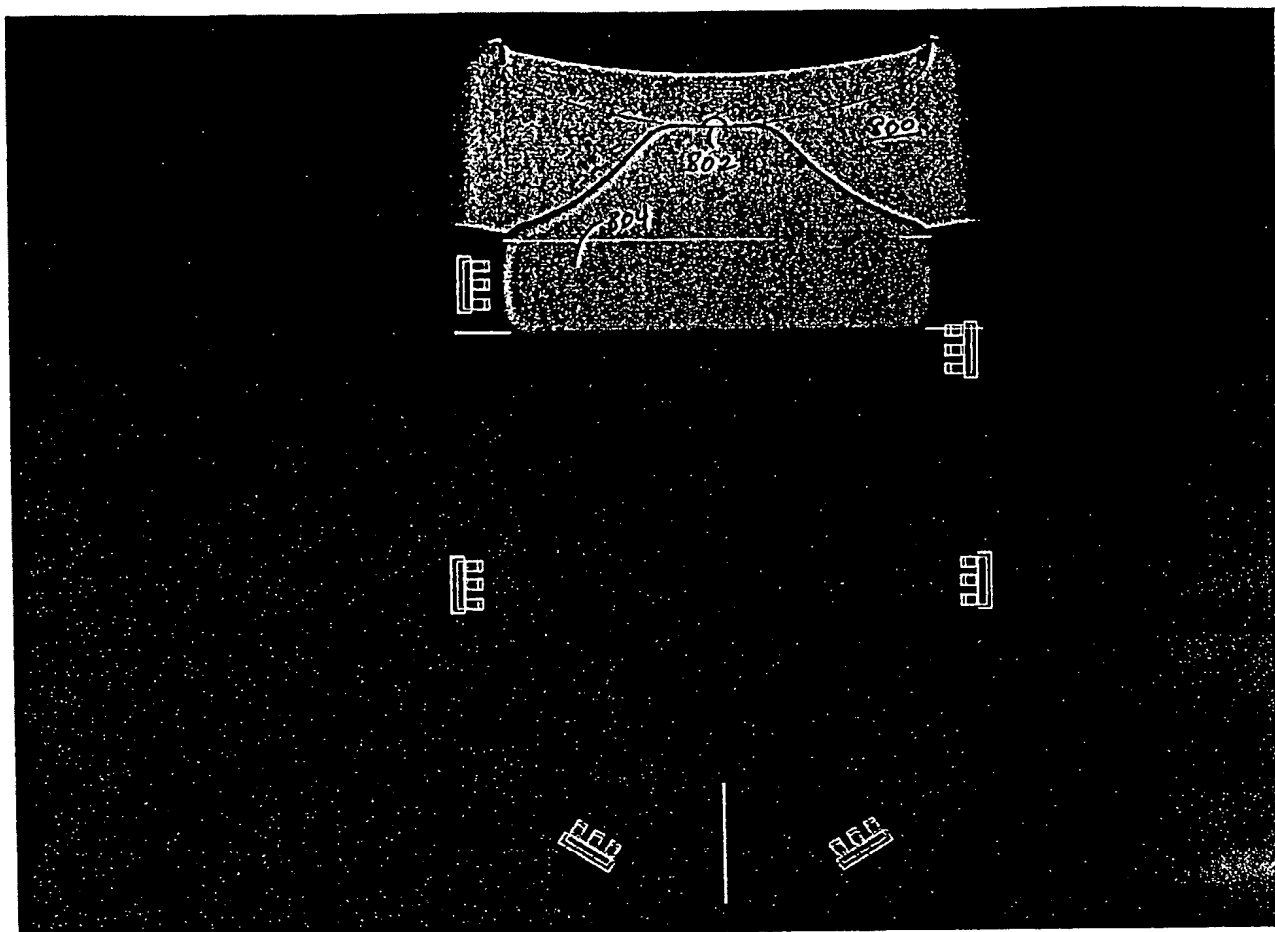


FIG 15



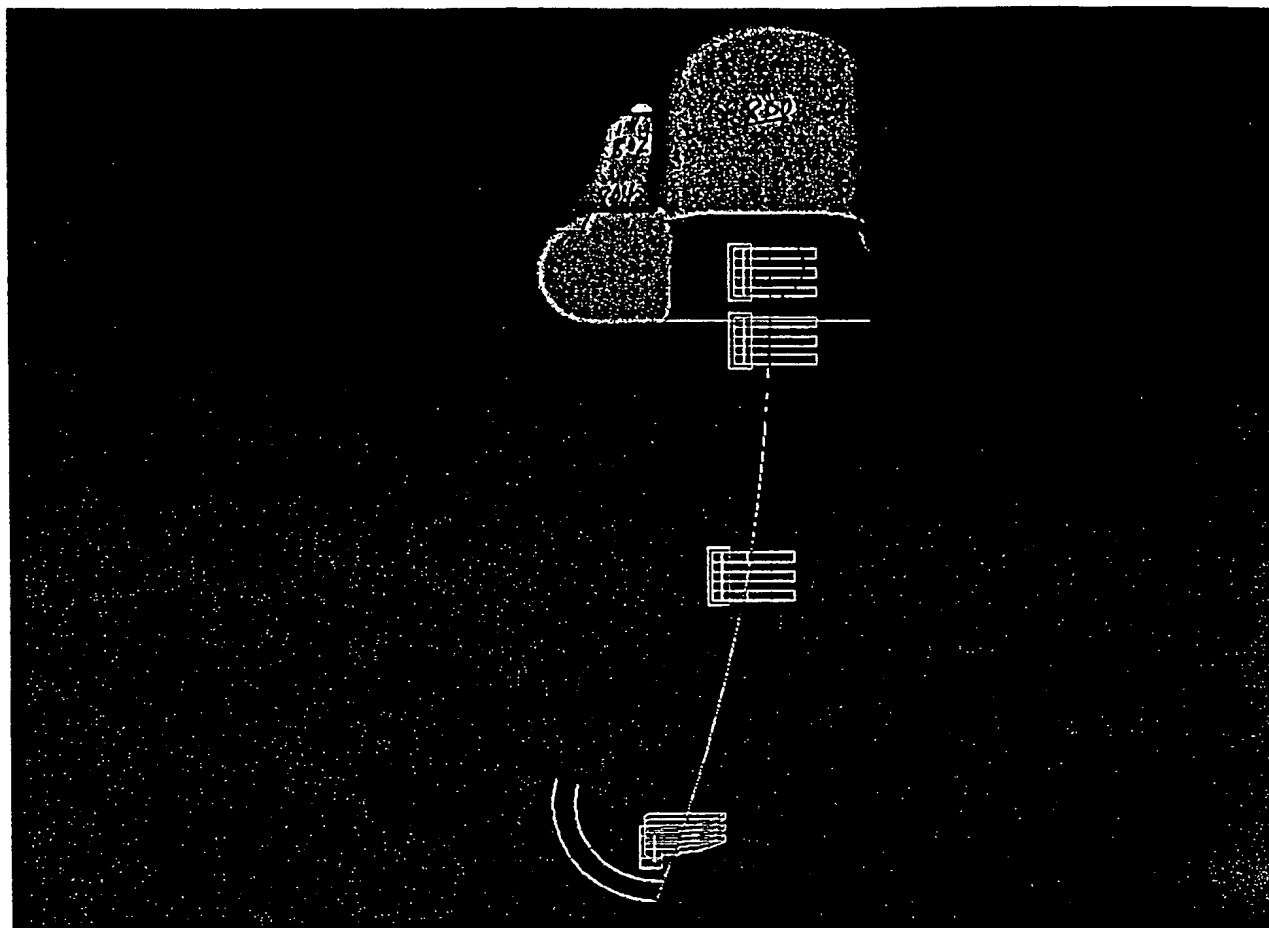


FIG. 16

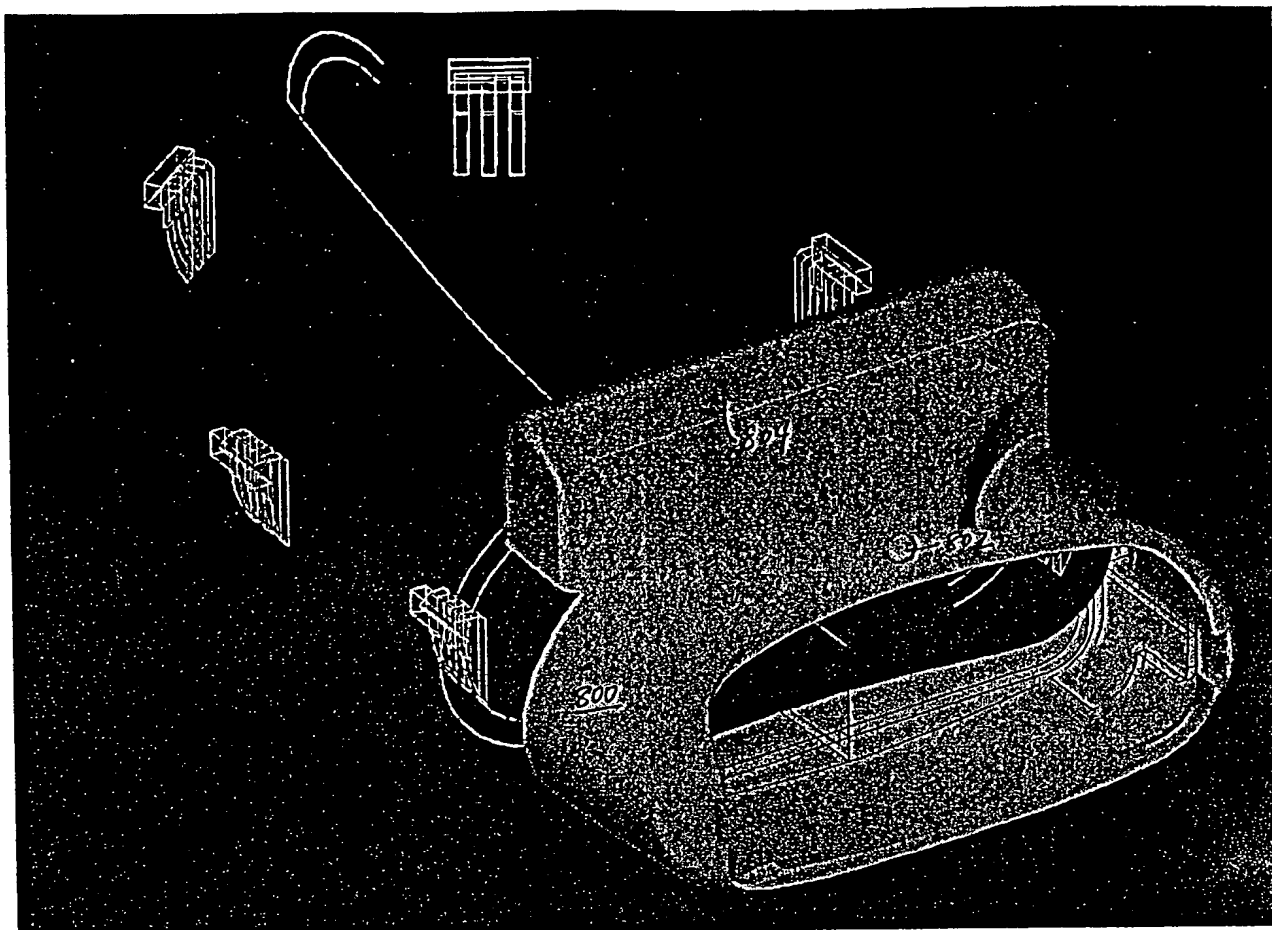


FIG. 17

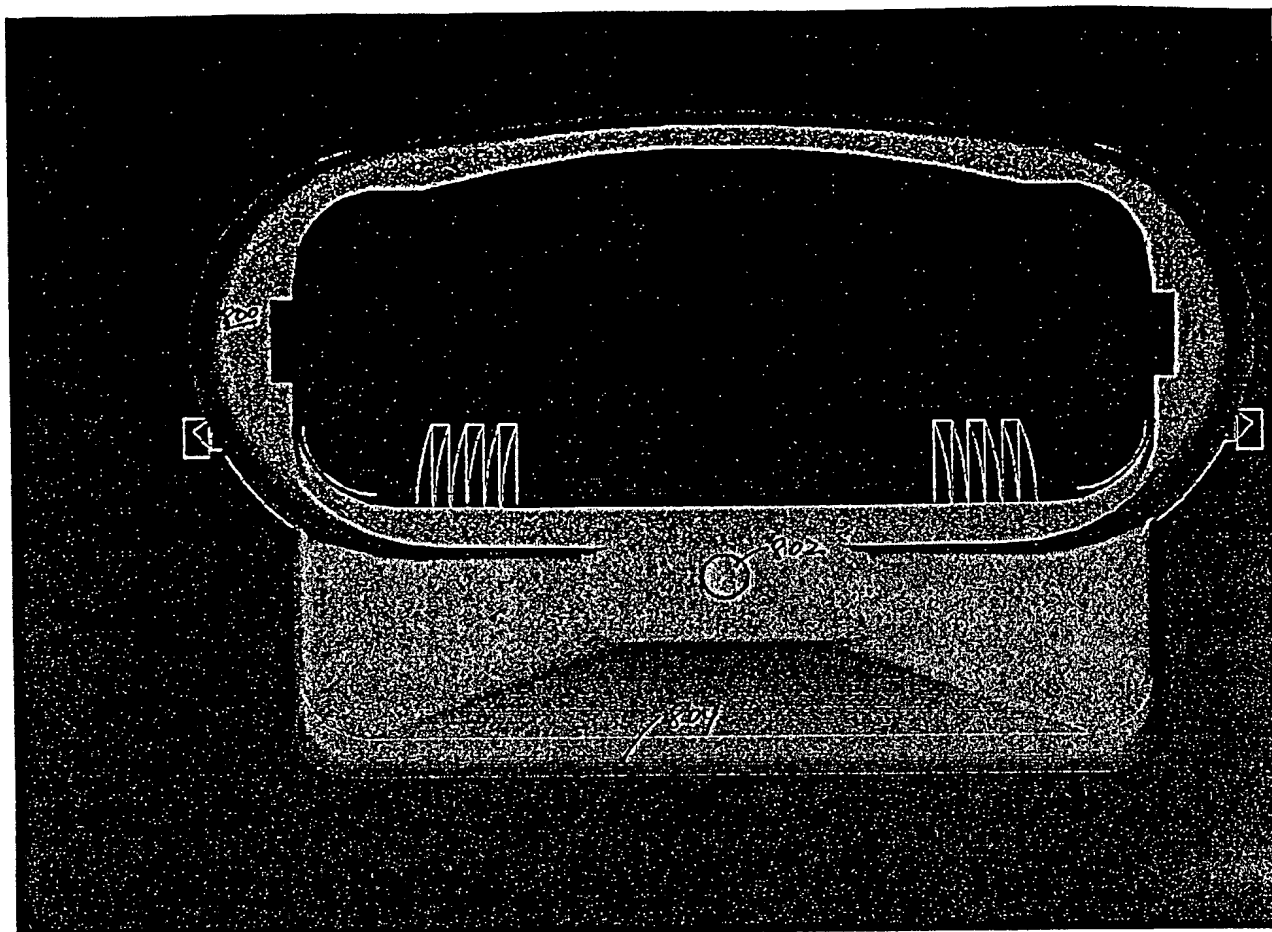


FIG. 18

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/CN01/01639

## A. CLASSIFICATION OF SUBJECT MATTER

A45D26/00

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7 A45D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI, EPODOC, PAJ

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	CN1044753A (UNTEREGGER Johann et al.) 22 August 1990 See the whole document	1-10
Y	EP613632A (DOLEV, Moshe ) 07 September 1994 See the whole document	1-10
Y	FR2699448 (CARLIER Jean et al.) 24 June 1994 See the whole document	2-10
X	FR2699448 (CARLIER Jean et al.) 24 June 1994 See the whole document	21-37
A	FR2686001 (Oliveau Patrice et al.) 16 July 1993 See the whole document	1

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E" earlier application or patent but published on or after the international filing date	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L" document which may throw doubts on priority claim (S) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&" document member of the same patent family
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search 24 March 2000 (24.03.2002)	Date of mailing of the international search report 14 MAR 2002 (14.03.02)
Name and mailing address of the ISA/CN 6 Xitucheng Rd., Jimen Bridge, Haidian District, 100088 Beijing, China Facsimile No. 86-10-62019451	Authorized officer Xie Gang Telephone No. 86-10-62093950



# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/CN01/01639

## Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos:  
because they relate to subject matter not required to be searched by this Authority, namely:
  
2. ☐ Claims Nos:  
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
  
3. ☐ Claims Nos:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a)

## Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

There are four independent claims in this international application. Each independent claim comprises different technical features from others, and defines a kind of hair removal device.

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☒ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
  
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

### Remark on protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

**INTERNATIONAL SEARCH REPORT**  
Information on patent family members

International application No.  
PCT/CN01/01639

Patent document cited in search report	Publication date	Patent family member (s)	Publication date
CN1044753A	22 -08-1990	EP381876	16-08-1990
		US 5084056	28-01-1992
		BR890647	13-11-1990
EP613632A	07 -09-1994	US 5281233	25-01-1994